

REDUCING CONTENT OF N AND P IN DAIRY NUTRITION

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Description

Lowering N and P intake without loss of feeding value with respect to the value of net energy for lactation. This issue needs to be addressed with (home-grown) roughages and concentrates or by-products, and for high- and low-yielding cows.

Rationale, mechanism of action

A close relationship exists between the excretion of N and P by dairy cattle and the amounts consumed with feed. Hence, there are good options to reduce P excretion by nutritional measures. In many regions, grass delivers the main fraction of dietary P, whereas soil P status strongly determines P content of grass. This means that changes in whole farm management which lead to a lower soil P status will directly affect P excretion and the efficiency of P retention in milk. Trade-offs with changes in roughage quality and net energy value always need to be taken into account. Alternatively, grass may be replaced by maize which immediately leads to a substantial reduction in P intake while stimulating feed intake and milk yield per cow. Also, changes in the choice of concentrates composition may lead to a reduced P content of concentrates and hence less P intake by the cow. Adopting the first two options (grass and maize) requires analysis of the combination of nutritional effects and effects of farm nutrient management. The latter option requires consideration of nutritional effects only, including feed costs.

From a nutritional perspective, there is a lot of room for reducing the N and P content in diets [1]. Making use of the high capacity of dairy cattle to recycle urea-N and P from blood to the rumen ensures that rumen fermentation will be maintained, even in the low range of dietary N and P content. However, critical limits to N and P availability to rumen micro-organisms needs to be taken into account, if known. Also analysis is required from an animal metabolic perspective. The N and P metabolism in dairy cows differs strongly, with emphasis on rumen function and protein digestibility in the case of N, and emphasis on the dynamic aspects of P metabolism and P storage in bone in the case of P (P absorbability is less important).

Applicability

Nutritional measures are just as important for extensive as intensive farming. Effects of gaining efficiency in N and P utilization will probably be largest with intensive farming systems, although this strongly depends on the units of expression chosen (animal, herd, unit milk/meat, hectare, unit feed, unit of purchased feed).

Effectiveness, including certainty

In principle, dairy cattle can become highly efficient in utilizing N and P. However, there are internal and external restrictions to farm management which makes maximization of N and P utilization and minimizing N and P excretion not a priori the optimal solution. Furthermore, there is uncertainty on the minimum requirements on N and P by dairy cattle, which definitely needs to be sorted out. For example, huge differences exist in P recommendations among various countries [1]. Substantial reduction in dietary N and P content while maintaining diet quality (and hence production levels) may impair cow health and this issue deserves further attention in any research on maximizing N and P utilization by dairy cattle.

Time frame

Nutritional measures immediately affect changes in N and P excretion. The same holds for fertilization which immediately affects soil N status. But, for the intensively managed soils with a high P status effects can only be expected at the longer term (decennia probably) which is no argument for denying the relevance to act on the short term and set a trend.

Environmental side-effects / pollution swapping

There probably will be no pollution swapping with respect to P losses to the environment. There is a clear trade-off, however, between methane emissions on the one hand, and N excretion and nitrous oxide (and ammonia ?) emissions on the other hand. Roughages or diets with a high N content results in relatively low methane emission [2].

Relevance, potential for targeting, administrative handling, control

Feeding measures are one of the most straightforward measures to take with the aim of reducing N and P excretion and losses to the environment. Research is needed how to achieve this in balance with

Costs: investment, labor

Additional costs or investments may be the higher cost of purchased (P-poor) feeds, or the investment needed to achieve optimal control on the diet consumed. When reducing the fertilization rate of soils with a high N and P status probably no major effects will be seen on the short term. On the long term, however, N and P may be mined from these soils and roughage quality may decrease. As a result of such a less productive soil and roughage harvested, a totally different farm management may be needed and farm income will be seriously affected.

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